education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL
SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS
PAPER 1

COMMON TEST

JUNE 2018

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and 1 data sheet.

INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 10A) in the appropriate spaces on the ANSWER BOOK.

2. Answer ALL the questions in the ANSWER BOOK.

3. Number the answers correctly according to the numbering system used in this question paper.

4. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.

5. You may use a non-programmable calculator.

6. You are advised to use the attached DATA SHEETS.

7. Show ALL formulae and substitutions in ALL calculations.

8. Round off your final answers to a minimum of TWO decimal places.

9. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions.
Each question has only ONE correct answer. Choose the answer and write only
the letter (A – D) next to the question number (1.1 – 1.7) in the ANSWER BOOK,
for example 1.8 C.

1.1   The volume of sound decreases when there is a decrease in the sound wave's ….

A   wavelength
B   frequency
C   amplitude
D   period   (2)

1.2   Ultrasound is used by doctors to examine an unborn baby. The principle of
ultrasound scanning is based on….

A   superposition
B   refraction
C   reflection
D   diffraction   (2)

1.3   The energy of a photon is directly proportional to its…

A   wavelength
B   frequency
C   amplitude
D   period   (2)

1.4   Consider the following statements concerning magnetic fields:

(i)   Magnetic field lines never touch each other
(ii)   The strength of the magnetic field is indicated by the closeness
of the field lines.
(iii)   The magnetic field of a bar magnet is weaker at the poles.

Which of the above statements are CORRECT?

A   i, ii and iii
B   i and ii
C   i and iii
D   ii and iii   (2)

1.5   Two charged spheres, X and Y are made to touch each other and are then
       separated.
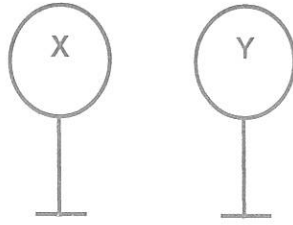
       Which one of the following is most probable for these two charges?

	BEFORE TOUCHING		AFTER TOUCHING and SEPARATED
	X	Y	
A	+ 5,2 C	Neutral	X gained electrons
B	-3 C	-7 C	Y gained electrons
C	-3 C	-7 C	X lost electrons
D	+ 5,2 C	Neutral	X lost electrons

(2)

1.6   The unit of measurement for the rate of flow of charge in an electric circuit is …

       A   coulomb
       B   ampere
       C   ohm
       D   joule   (2)

1.7   The energy transferred per unit charge across the ends of a conductor is
       best described as...

       A   potential difference
       B   power
       C   electrical current
       D   work done   (2)
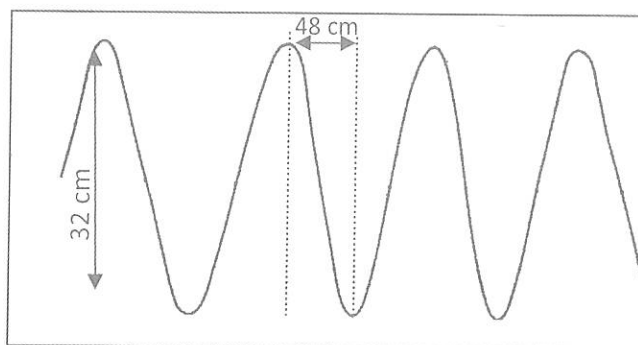   [14]

QUESTION 2

Two learners stand 6 m apart and demonstrate a transverse wave with a slinky spring by moving it quickly up and down.

The wave train produced has the following features:

1. a vertical distance of 32 cm between crest and trough,
2. a horizontal distance of 48 cm from a trough to the following crest.
3. a frequency of 2.4 Hz

2.1   Define a *crest*.   (2)

2.2   Determine the amplitude of the wave.   (1)

2.3   Define a *wavelength*.   (2)

2.4   Calculate the wavelength of the wave.   (1)

2.5   Determine the time taken for the wave train to travel 6 m.   (4)

The learners now push and pull on the slinky spring to produce a wave shown below:
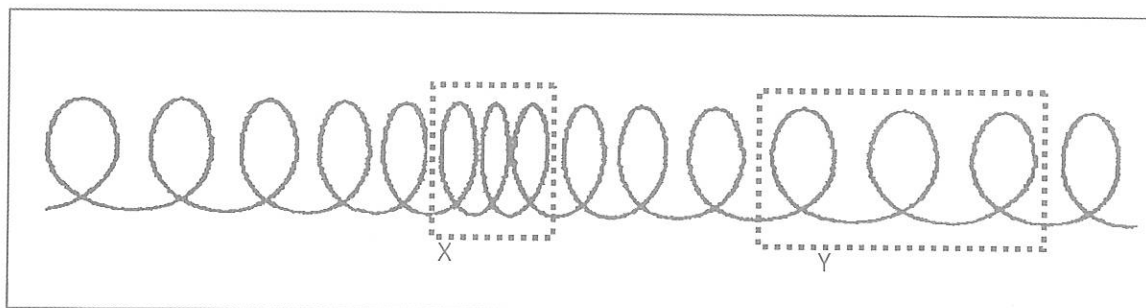
2.6   What type of wave moves through the spring?   (1)

2.7   Name the areas labelled X and Y.   (2)

2.8   They produce 5 wave cycles in 2 s. What is the frequency of the wave?   (2)

[15]

QUESTION 3

A band decides to do an experiment on sound during a cool summer's day.
Specific different sound notes are produced using a musical instrument.
The frequency of the sound notes are measured and recorded in the table below:

NOTE PLAYED BY MUSICIAN	WAVELENGTH OF THE NOTE (m)	FREQUENCY OF THE NOTE (Hz)
A	4	84
B	5	68
C	8	44
D	20	18

A graph of the data is plotted below.
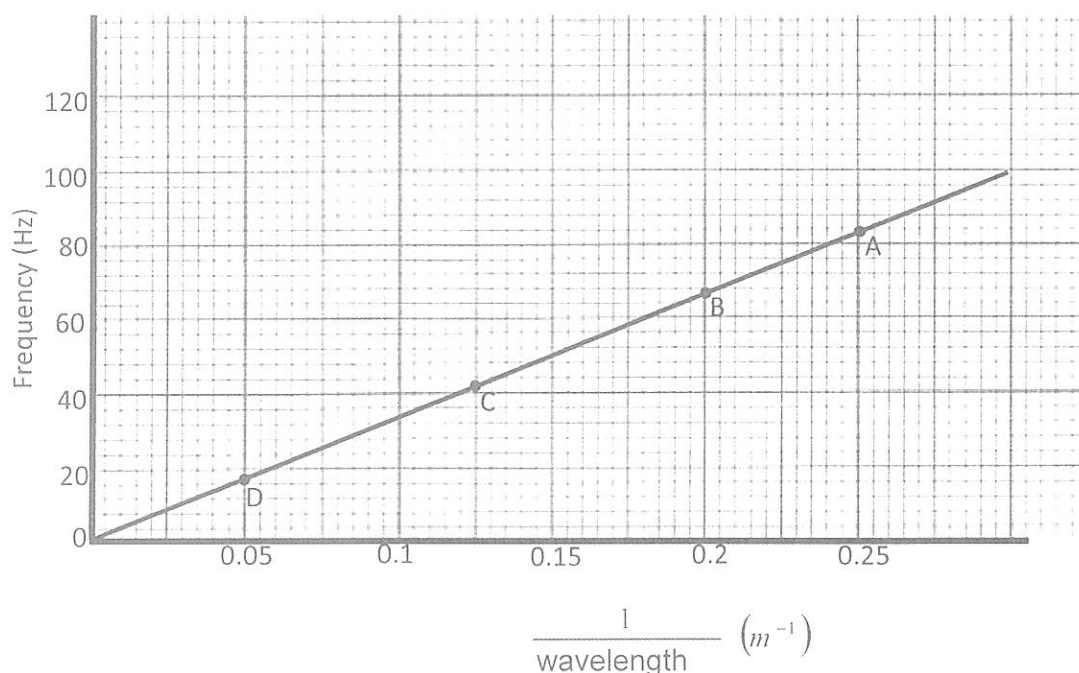
3.1 How long does it take to produce one wave cycle of note A?   (2)

3.2 Write down the dependent variable for this experiment.   (1)

3.3 Calculate the gradient of this graph.   (3)

3.4 What physical quantity does the gradient represent?   (1)

3.5 What is the mathematical relationship between frequency and wavelength of a sound wave?   (1)

3.6 How will the gradient of the graph be affected if the same experiment was carried out on a very hot day?
(Choose from: STEEPER THAN; EQUAL TO or LESS STEEPER THAN)   (1)
       [9]

QUESTION 4

4.1   How is an electromagnetic wave created?   (2)

Consider the two electromagnetic waves A and B below:

ELECTROMAGNETIC WAVE		FREQUENCY (Hz)	WAVELENGTH (m)
A	Ultraviolet radiation	7×10^{16}	
B	Radio waves		0,025

4.2   Calculate the frequency of wave B.   (3)

4.3   Which wave has the higher penetrating ability? Give a reason for the answer.   (2)

4.4   Calculate the energy of a photon of the electromagnetic wave A.   (3)

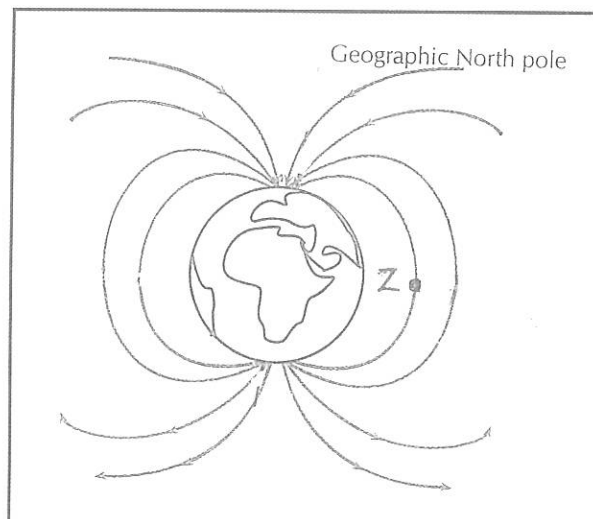4.5   What type of electromagnetic radiation is used by cell phones?   (1)

4.6   State one use of x-rays.   (1)

                                                                                                                                  [12]

QUESTION 5

The diagram shows the magnetic field lines around the Earth which is very much similar to the magnetic field pattern of a giant bar magnet.

5.1   Define *magnetic field*.   (2)

5.2   To which pole of the bar magnet does the magnetic north pole of the Earth correspond to? Use the diagram to give a reason for the answer.   (2)

5.3   A compass is used to indicate direction.
        In which direction will the compass needle point when placed at point Z?
        Choose NORTH or SOUTH.   (1)

5.4   Which metal, aluminium or iron, would be most suitable to use in making a compass needle? Give a reason.   (2)

5.5   How does the earth's magnetic field protect us from solar winds?   (2)

[9]

QUESTION 6

Two identical metal spheres are placed on insulated stands. Sphere A carries a charge of -3nC and sphere B is UNCHARGED.
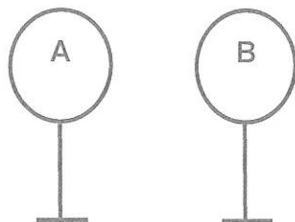
6.1   What is meant by sphere B is *uncharged*?   (1)

6.2   Calculate the number of excess electrons on sphere A.   (2)

Sphere A is brought CLOSE to sphere B without them touching.

6.3   Describe the changes that take place on sphere B.   (2)

The two spheres are NOW made to TOUCH each other and are then separated.

6.4   Will electrons be transferred from **A to B** or from **B to A**?   (1)

6.5   Calculate the final charge on each sphere after separation.   (2)

6.6   State the law of conservation of charge.   (2)

6.7   Calculate the amount of charge transferred when spheres were in contact.   (2)

6.8   Will the spheres exert forces of attraction or repulsion on each other? Give a reason.   (2)
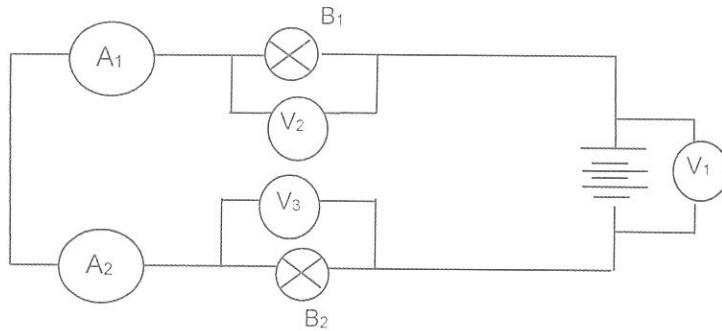
[14]

QUESTION 7

Learners want to determine the voltage across the resistors and the battery in a circuit.

Learners use THREE 1,5 V cells; TWO identical bulbs, ammeters and voltmeters to set up a circuit as shown below.

Ignore the resistance of the battery and the wires.

Study the circuit below and answer the questions that follow:

7.1   Are the voltmeters connected *in series* or *in parallel* in the circuit?   (1)

7.2   Explain why the voltmeters are connected in this way.   (2)

7.3   Calculate the reading on the voltmeter V_1.   (1)

7.4   How does the reading on voltmeter V_2 compare to the reading on voltmeter V_3?
       (Choose from: **GREATER THAN; EQUAL TO or LESS THAN**)   (1)

7.5   Write out an equation to show the relationship between the
       readings on V_1, V_2 and V_3.   (2)

7.6   How does the reading on ammeter A_1 compare to the reading on ammeter A_2?
       (Choose from: **GREATER THAN; EQUAL TO or LESS THAN).**
        Give a reason for the answer.   (2)

7.7   Bulb B_1 burns out. How will the reading on A_2 be affected?
       (Choose from: **INCREASES; DECREASES or BECOMES ZERO)**
       Give a reason for the answer.   (2)
                                                                                                                        [11]

QUESTION 8

Study the circuit diagram below. Ignore the resistance of the battery and the wires.

The light bulbs X, Y and Z are identical. The resistance of each bulb is 3 Ω.
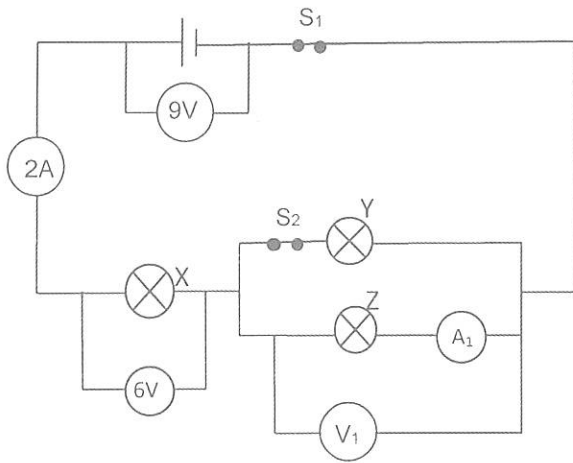
8.1   Define *one ohm*.   (2)

8.2   Calculate the total resistance of the circuit.   (4)

8.3   What is the reading on ammeter A_1?   (2)

8.4   How much electrical energy is transferred to bulb X when charges flows through
        bulb X for 1 minute?   (4)

8.5   Determine the reading on the voltmeter V_1.   (2)

8.6   Both switches S_1 and S_2 is now opened.

        8.6.1   How will this affect the reading on the voltmeter that is connected
                across the terminals of the battery?
                (Choose from INCREASES; DECREASES or REMAINS THE SAME).   (1)

        8.6.2   What is this reading called?   (1)
                                                                                                   [16]

                                                                        TOTAL MARKS: 100

Please Turn Over

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	$3,0 \times 10^8$ m·s^{-1}
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg
Electron charge	q_e	$-1,6 \times 10^{-19}$ C

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f \lambda$ **or** $c = f \lambda$	$T = \dfrac{1}{f}$	$E = hf$

ELECTROSTATICS

$n = \dfrac{Q}{Q_e}$	$Q = \dfrac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUIT

$Q = I \, \Delta t$	$\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dots$
$R_s = R_1 + R_2 + \dots$	$V = \dfrac{W}{Q}$
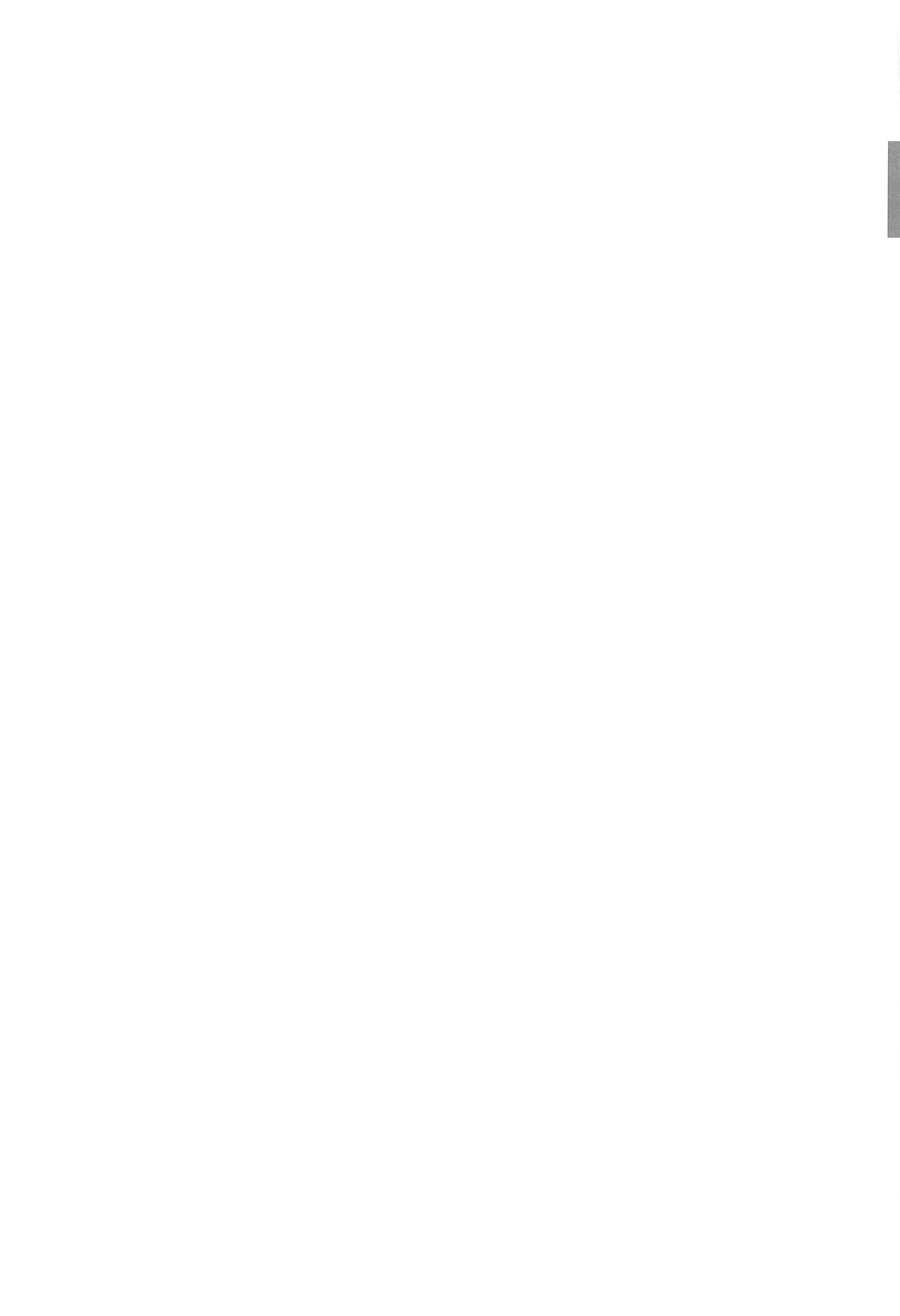
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PROVINCE OF KWAZULU-NATAL

PHYSICAL SCIENCES P1 (PHYSICS)

COMMON TEST

MARKING GUIDELINE

JUNE 2018

NATIONAL SENIOR
CERTIFICATE

GRADE 10

MARKS: 100

This marking guideline consists of 5 pages.

QUESTION 1

1.1   C ✓✓   (2)

1.2   C ✓✓   (2)

1.3   B ✓✓   (2)

1.4   B✓✓   (2)

1.5   A✓✓   (2)

1.6   B✓✓   (2)

1.7   A✓✓   (2)

                                 [14]

QUESTION 2

2.1   Highest point (peak) on a wave ✓✓   (2)

2.2   A = 16 cm ✓   (1)

2.3   The distance between two consecutive points that are in phase ✓ ✓   (2)

2.4 λ = 2 x 48 = 96 cm ✓   (1)

2.5 $v = f.\lambda$ ✓

       $= (2,4)\ (96\times10^{-2})$ ✓

       $= 2{,}304\ m.s^{-1}$

       $\Delta t = \dfrac{D}{v} = \dfrac{6}{2{,}304}$ ✓ $= 2{,}60\ s$ ✓

       <u>Positive marking from Q 2.4</u>

       OR

       $T = \dfrac{1}{f} = \dfrac{1}{2{,}4}$ ✓ $= 0{,}42 s$

       $\Delta t = \dfrac{6\times 0{,}42}{96\times 10^{-2}}$ ✓ $= 2{,}63 s$ ✓   (4)

2.6   longitudinal ✓   (1)

2.7   X: compression ✓   Y: rarefaction ✓   (2)

2.8 $f = \dfrac{waves}{\Delta t} = \dfrac{5}{2} = 2{,}5\ Hz$ ✓✓   (2)

                                   [15]

QUESTION 5

5.1 A magnetic field is a region in space where a magnet or ferromagnetic material will experience a force. ✓✓ (2)

5.2 south pole ✓ the direction of magnetic field lines is from north to south✓ (2)

5.3 North ✓ (1)

5.4 Iron ✓ / iron is a ferromagnetic substance ✓ or iron is easily magnetised in the earth's magnetic field. ✓ (2)

5.5 The magnetosphere deflects the greater part of the charged particles away from the sun. ✓✓ (2) **[9]**

QUESTION 6

6.1 The number of electrons is equal to the number of protons ✓ OR. There is no excess charge. ✓ (1)

6.2 $number\ of\ excess\ electrons = \dfrac{-3\times10^{-9}}{-1.6\times10^{-19}} = 1.875\times10^{10}$ ✓✓ (2)

6.3 The electrons in sphere B will be repelled✓ by the excess electrons in sphere A, resulting in a separation of charge in sphere B. ✓ (2)

6.4 A to B ✓ (1)

6.5 $Q = \dfrac{Q_1 + Q_2}{2} = \dfrac{-3\times10^{-9} + 0}{2} = -1.5\times10^{-9}\ C$ ✓✓ (2)

6.6 Charge is neither created nor destroyed but transferred from one object to another. ✓✓ (2)

6.7 $\Delta Q = -1.5\times10^{-9} - (-3\times10^{-9}) = 1.5\times10^{-9}\ C$ ✓✓ (2)

6.8 repulsion ✓ like charges repel✓ (2) **[14]**

QUESTION 3

3.1 $T = \dfrac{1}{f} = \dfrac{1}{84} = 0.012\ s$ ✓✓ (2)

3.2 frequency ✓ (1)

3.3 $gradient = \dfrac{84-0}{0.25-0} = 336\ m.s^{-1}$ ✓ (accept range) (3)

3.4 speed of sound in air ✓   OR wave speed✓ (1)

3.5 frequency is directly proportional to the reciprical of wavelength ✓ or frequency is inversely proportional to wavelength ✓ (1)

3.6 Steeper than ✓ (1) **[9]**

QUESTION 4

4.1 Electromagnetic waves propagate when an electric field oscillating in one plane produces a magnetic field oscillating in a plane at right angles to it, which produces an oscillating electric field. These mutually generating magnetic and electric fields are propagated through space at right angles to each other as an electromagnetic wave.   OR oscillating electric and magnetic fields that mutually generate each other✓✓ (2)

4.2 c = f.λ ✓
$f = \dfrac{3\times10^8}{0.025}$ ✓ $= 120\ Hz$ ✓ (3)

4.3 Wave A ✓ higher frequency, greater penetrating ability. ✓ (2)

4.4 E = hf ✓
$= 6{,}63\times10^{-34} \times 7\times10^{16}$ ✓
$= 4{,}641\times10^{-17}\ J$ ✓ (3)

4.5 Microwaves ✓ (1)

4.6 CT scans ✓ or medical images ✓ or security scanners ✓ (1) **[12]**

QUESTION 7

7.1   Parallel ✓   (1)

7.2   The voltmeter measures the potential difference between two points

         In a circuit✓ ✓   (2)

7.3 $V_1 = 4.5\ V$ ✓   (1)

7.4   Equal to ✓   (1)

7.5 $V_1 = V_2 + V_3$ ✓✓   (2)

7.6   Equal to ✓   current is the same anywhere in a series circuit. ✓   (2)

7.7   Becomes zero✓   Bulbs connected in series therefore no current flows.✓   (2)

                                                       [11]

QUESTION 8

8.1   one volt per one ampere. ✓✓   (2)

8.2 $\dfrac{1}{R_p} = \dfrac{1}{3} + \dfrac{1}{3}$ ✓

         $R_P = 1.5\ \Omega$ ✓

         $R_T = R_P + R_S = 1.5 + 3 = 4.5\ \Omega$ ✓   (4)

8.3 $A_1 = 1A$✓✓   (2)

8.4 $Q = I.\Delta t$ ✓ $= 2 \times 60$✓ $= 120\ C$

         $W = V.Q = 6 \times 120$✓ $= 720\ J$✓   (4)

8.5 $V_1 = 9 - 6$ ✓ $= 3\ V$ ✓   (2)

8.6.1   Remains the same ✓   (1)

8.6.2   Emf ✓   (1)

                                                    [16]

TOTAL MARKS: 100